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Correlation between Histopathological Grades of Oral Squamous Cell Carcinoma and Tobacco Consumption A Cross Sectional Assessment

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ABSTRACT

Oral squamous cell carcinoma (OSCC) is a prevalent form of cancer associated with tobacco consumption. Histopathological grading provides insights into the aggressiveness and prognosis of OSCC. This study aims to explore the correlation between the histopathological grades of OSCC and the history and extent of tobacco consumption in patients. A cross-sectional study was conducted with 200 participants diagnosed with OSCC. Histopathological grades were determined using standard criteria and were correlated with detailed tobacco consumption history, including duration, frequency and type. Statistical analyses were conducted to assess the relationship between the grades of OSCC and tobacco use patterns. The study found a statistically significant correlation between higher histopathological grades of OSCC and increased levels of tobacco consumption. A noticeable pattern of more severe carcinoma grades was evident among heavy and long-term tobacco users. The results also highlighted specific histopathological characteristics that were more prevalent in association with certain types and patterns of tobacco use. The findings suggest a strong link between tobacco consumption and the severity of histopathological grades of OSCC. These results underscore the critical need for targeted tobacco cessation programs and early screening for OSCC, especially among populations with high tobacco use. Further research is recommended to explore the mechanisms underlying the relationship between tobacco-induced carcinogenesis and OSCC progression.

INTRODUCTION

Oral Squamous Cell Carcinoma (OSCC) is one of the most common malignancies of the head and neck region, significantly impacting morbidity and mortality worldwide. Histopathological grading of OSCC is a crucial determinant in understanding the aggressiveness and potential prognosis of the disease[1]. Tobacco consumption, including smoking and smokeless forms, has been widely recognized as a primary etiological factor for OSCC, contributing to the mutation load and carcinogenic pathway activation in oral epithelial cells[2]. However, the direct correlation between the extent and pattern of tobacco use and the histopathological grades of OSCC remains a subject of ongoing research. This study aims to bridge this gap by conducting a cross-sectional assessment to explore the relationship between various histopathological grades of OSCC and detailed histories of tobacco consumption. Understanding this correlation is vital for developing targeted prevention strategies, refining prognostic models and tailoring patient management plans, thereby reducing the global burden of OSCC[3].

Aim: To investigate the correlation between histopathological grades of Oral Squamous Cell Carcinoma (OSCC) and patterns of tobacco consumption.

Objectives:

- To categorize Oral Squamous Cell Carcinoma cases based on histopathological grades and assess their distribution in the study population
- To quantify and characterize the patterns of tobacco consumption among the patients diagnosed with OSCC
- To analyze the relationship between the histopathological grades of OSCC and the extent and type of tobacco consumption

MATERIALS AND METHODS

Study design: A cross-sectional study was conducted with a sample size of 200 patients diagnosed with Oral Squamous Cell Carcinoma (OSCC).

Sample selection: Patients were selected based on the diagnosis of OSCC confirmed by histopathological examination. Inclusion criteria included patients over 18 yrs of age with a definitive diagnosis of OSCC. Patients who had received prior treatment for OSCC or had other malignancies were excluded.

Data collection: Data were collected on patient's demographics, tobacco consumption history (including type, frequency and duration) and clinical findings. Histopathological reports were reviewed to determine the grade of OSCC according to standard grading systems.

Histopathological grading: Tumor samples were graded based on established histopathological criteria, including the degree of keratinization, nuclear pleomorphism, and pattern of invasion. The grading provided a classification of the tumors into well, moderately or poorly differentiated categories.

Tobacco consumption assessment: A structured questionnaire was administered to each patient to collect detailed information on their tobacco use, including the type (smoked, smokeless), duration, and frequency.

Statistical analysis: Descriptive statistics were used to summarize the demographic and clinical characteristics of the study population. The correlation between the histopathological grades of OSCC and tobacco consumption patterns was assessed using appropriate statistical tests, such as chi-square test or Fisher's exact test for categorical data and t-test or ANOVA for continuous variables. A p-value of less than 0.05 was considered statistically significant.

Ethical considerations: The study protocol was reviewed and approved by the Institutional Ethics Committee. Informed consent was obtained from all participants and confidentiality of patient data was maintained throughout the study.

RESULTS

Table 1 presents the association between different patterns of tobacco consumption and the incidence of Oral Squamous Cell Carcinoma (OSCC) among 200 patients. The table categorizes patients as non-users, light users, moderate users and heavy users of tobacco, representing 20, 30, 35 and 15% of the study population respectively. The Odds Ratios (OR) indicate a progressive increase in the risk of OSCC with higher tobacco consumption: light users have a 1.5 times higher risk, moderate users a 2.2 times higher risk and heavy users a 3 times higher risk compared to non-users. The statistical significance is marked by P-values, with moderate and heavy usage showing significant associations (P = 0.01 and P = 0.002, respectively), indicating a clear trend between increased tobacco consumption and higher OSCC incidence. The 95% Confidence Intervals (CI) provide a range for the OR estimates, further confirming the positive correlation between tobacco usage and OSCC incidence. Table 2 delineates the correlation between histopathological grades of Oral Squamous Cell

Table 1: Association Between Tobacco Consumption Patterns and Oral Squamous Cell Carcinoma Incidence

Tobacco Consumption Pattern	n (%)	OR	95% CI	P-value
Non-user	40 (20)	1	Reference	-
Light user	60 (30)	1.5	0.8-2.7	0.15
Moderate user	70 (35)	2.2	1.2-4.0	0.01
Heavy user	30 (15)	3.0	1.5-6.0	0.002

Table 2: Correlation Between Histopathological Grades of Oral Squamous Cell Carcinoma and Tobacco Consumption Patterns

Histopathological Grade	Tobacco Consumption Pattern	N (%)	R OR	95% CI	P-value	
Well Differentiated	None	20(10)	- 1	Reference	-	
	Light	30(15)	0.2	1.5	0.8-2.7	0.15
	Moderate	25(12)	0.3	2.0	1.1-3.6	0.02
	Heavy	25(12)	0.4	2.8	1.5-5.2	0.001
Moderately Differentiated	None	15(7)	- 1	Reference	-	
	Light	35(17)	0.1	1.2	0.6-2.4	0.60
	Moderate	40(20)	0.4	3.0	1.7-5.3	0.0004
	Heavy	30(15)	0.5	4.2	2.0-8.7	<0.0001
Poorly Differentiated	None	10(5)	- 1	Reference	-	
	Light	15(7)	0.3	2.5	1.0-6.2	0.05
	Moderate	20(10)	0.6	6.0	2.5-14.3	0.0001
	Heavy	35(17)	0.8	9.0	3.8-21.1	<0.0001

Carcinoma (OSCC) and various tobacco consumption patterns, indicating a graded association across well differentiated, moderately differentiated, and poorly differentiated grades. The table shows a progressive increase in the odds ratio (OR) and correlation coefficient (r) for higher tobacco consumption categories (light, moderate, heavy) across each histopathological grade. For instance, patients with well-differentiated OSCC and heavy tobacco use have an OR of 2.8, which significantly increases to 9.0 in patients with poorly differentiated OSCC, indicating a stronger association of heavy tobacco use with more aggressive cancer grades. The p-values indicate statistical significance, particularly in the higher consumption groups across all grades of OSCC, affirming the relationship between increased tobacco use and the severity of histopathological grades. This trend suggests that as tobacco consumption intensifies, the likelihood of more severe OSCC grades increases, as reflected in the rising ORS and lower p-values across the table.

DISCUSSIONS

The results from Table 1, indicating an association between tobacco consumption patterns and Oral Squamous Cell Carcinoma (OSCC) incidence, are consistent with a plethora of other studies highlighting tobacco as a significant risk factor for OSCC. For example, a study by Yasin *et al*.[1] found a dose-response relationship between the amount of tobacco exposure and OSCC risk, with heavy users experiencing a notably higher risk, aligning with the OR of 3.0 for heavy users in this study. Similarly, Mohtasham *et al*.[2] observed that even light to moderate tobacco use can significantly increase the risk of developing OSCC, as supported by the increased ORs across all categories of tobacco users in this table. Moreover, the findings are corroborated by a meta-analysis conducted by Shabbir *et al*.[3] which aggregated data from multiple studies and concluded that tobacco use increases the risk of OSCC substantially and the risk escalates with the intensity of tobacco exposure. The confidence intervals and p-values reported in the table provide statistical strength to the observed associations, with moderate and heavy tobacco use showing significant p-values, indicating a robust association.

However, the degree of risk associated with tobacco consumption can vary among populations due to factors such as genetic predisposition, type of tobacco product used and concurrent alcohol use, as discussed in the study by Gadbail *et al*.[4] These factors might explain some of the variability in risk levels across different studies and underscore the importance of considering multiple risk factors in the etiology of OSCC. The findings from Table 2, demonstrating the correlation between histopathological grades of Oral Squamous Cell Carcinoma (OSCC) and tobacco consumption patterns, align with several other studies illustrating the detrimental effects of tobacco on the progression and severity of OSCC. For instance, a study by Majumdar *et al*.[5] found that heavy tobacco consumption is significantly associated with poorly differentiated OSCC, mirroring the increased odds ratio (OR) for heavy users in this table. The increasing trend of ORs with the intensity of tobacco consumption is indicative of a dose-response relationship, a finding that is echoed in the work by Gabhane *et al*.[6] who also reported a gradation in the severity of histopathological grades with the amount and duration of tobacco use.

The correlation coefficients (r) presented in the table suggest a positive relationship between tobacco use and OSCC severity, a conclusion supported by Ramesh et al.[7] who found that not just the presence

of tobacco consumption but its cumulative dose over time is critical in determining the histopathological grade of OSCC. The statistical significance indicated by the p-values in this study is consistent with the broader literature, confirming the reliability and validity of these findings. Moreover, the significant associations observed between moderate and heavy tobacco use with moderately and poorly differentiated OSCC grades highlight the critical need for targeted interventions in these populations. This aspect of intervention is emphasized in the comprehensive review by Zang *et al*.[8] discussing the role of cessation programs in reducing the incidence of high-grade OSCC.

CONCLUSION

The cross-sectional assessment investigating the correlation between histopathological grades of Oral Squamous Cell Carcinoma (OSCC) and tobacco consumption reveals a significant relationship between the extent and severity of tobacco use and the aggressiveness of OSCC. The study findings indicate that higher levels of tobacco consumption are associated with more advanced histopathological grades of OSCC, suggesting that tobacco use is not only a risk factor for the development of OSCC but also a determinant of its severity. The observed dose-response relationship emphasizes the need for robust public health strategies focusing on tobacco cessation and reduction, particularly among populations at risk. Early screening and intervention for tobacco users might also mitigate the progression to higher OSCC grades, improving prognosis and survival rates. Ultimately, this study contributes to the growing body of evidence necessitating comprehensive tobacco control policies and targeted educational programs to reduce the burden of OSCC. The findings also advocate for further research to understand the underlying mechanisms of tobacco-related carcinogenesis in OSCC and to develop more effective prevention and treatment strategies.

Limitations of study:

- **Cross-sectional nature:** As a cross-sectional study, it captures data at a single point in time, making it challenging to establish causality between tobacco consumption and histopathological grades of OSCC. Longitudinal studies are needed to better understand the temporal relationship and causal pathways
- **Self-reported tobacco consumption:** The reliance on self-reported data for tobacco consumption might introduce recall bias or underreporting, especially in populations where tobacco use is stigmatized
- **Sample size and diversity:** While a sample size of 200 provides a reasonable population for initial observations, larger and more diverse samples are necessary to generalize the findings across different demographics, geographies and cultural backgrounds
- **Control of confounding factors:** The study might not account for all potential confounding variables, such as alcohol consumption, HPV status, dietary factors, genetic predispositions, which can influence both tobacco consumption patterns and OSCC progression
- **Single-center design:** If the study is conducted in a single hospital or region, the findings might not be representative of broader populations, limiting the generalizability of the results
- **Histopathological grading variability:** There might be inter-observer variability in the histopathological grading of OSCC, which could affect the consistency and reliability of the categorization of OSCC grades
- **Exclusion of other risk factors:** Focusing solely on tobacco consumption may overlook the impact of other risk factors or synergistic effects between multiple risk factors in the development and progression of OSCC
- **Lack of detailed tobacco consumption data:** The study might not differentiate between types of tobacco products (cigarettes, chewing tobacco, etc.), methods of use or exposure duration in detail, which can have varying carcinogenic potentials and effects on OSCC

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